Benchmark Report

Microsoft Dynamics AX 4.0

Standard Benchmark on Hewlett-Packard Proliant Servers

Date: September, 2006

In August 2006, Microsoft Corporation conducted the Microsoft Dynamics AX™4.0 Standard distribution benchmark to measure the performance and scalability characteristics of Microsoft Dynamics AX 4.0 in a simulated distribution scenario. This benchmark exercised core Accounts Receivables scenarios around order entry through invoicing, in addition to Procure to Pay processes around purchase order creation through receiving of goods. The scenarios generate load on an Application Object Server (AOS)—in this benchmark, each AOS instance was hosted on a separate server. In a Microsoft Dynamics AX system, the AOS processes business logic in communication with clients and the database; the database server provides data to the AOS.

At the 1,000 concurrent user level, server usage and system response times show good results. Server usage is less than 50% and response times are less than one second (with the exception of Sales Order Invoice which is between 1 and 2 seconds). Without encountering locking, the benchmark showcased 55,000+ Lines per hour for these scenarios.

The Simple Sales Order scenario (Scenario 3) offers a comparison point with industry benchmarks, which typically test less functionality than was tested here. In this scenario, 3,000 concurrent users were tested.

Results Summary

The benchmark was conducted around three core scenarios:

Scenario 1: Mixed Workload

- **Description**: Scenario to showcase ability to run mixed workloads, including sales order processing, purchase order processing, and ledger posting, without hitting scalability or response time outage issues.
- **Goal**: Provide a good sizing data point for customers/partners for the AOS and database servers, with representative functionality.

Scenario 2: Complex Sales Order Processing

- **Description**: Scenario provides an additional data point by processing complex sales orders alone. This scenario excludes purchase orders and general ledger postings, which are far lighter.
- **Goal**: Provide a good sizing data point for customers around AOS and database servers, with representative functionality.

Scenario 3: Simple Sales Orders, Industry Compare

- **Description**: This scenario has the following functional elements disabled to reduce the functional footprint by approximately half: credit limit checking, markup transactions, automatic reservations, commission calculation, and trade agreements.
- **Goals**:
  - Industry benchmarks often test limited functionality. This scenario is a comparison point with industry benchmarks around Order to Cash / Sales & Distribution Scenarios.
  - Provide a data point on core technology platform scalability for simple well optimized transactions.

High Level Results Summary

Response Time Measurement	Scenario 1: Mixed Workload	Scenario 2 Complex Sales Orders	Scenario 3: Industry Compare
Benchmark Core Compare			
Concurrency	1,000 Users	1,000 Users	3,000 Users
AOS Server Count	8	8	8
Users Per AOS	125	125	375
% Utilization per AOS	40.29%	45.21%	68.22%
Database Server Utilization	38.26%	44.14%	82.02%
Throughput (Lines Per Hour)			
Line Throughput Per Hour	56,645	55,374	165,045
Response Time (In Seconds)			
Sales Order Header Creation	0.18	0.20	0.48
Sales Order Line Creation	0.40	0.43	0.46
Sales Order Packing Slip Creation	0.66	0.71	1.22
Sales Order Picking List Generation	0.64	0.68	1.25
Sales Order Invoice	1.68	1.97	2.03
Ledger Header Creation	0.08	N/A	N/A
Ledger Line Creation	0.10	N/A	N/A

Response Time Measurement	Scenario 1: Mixed Workload	Scenario 2 Complex Sales Orders	Scenario 3: Industry Compare
Ledger Posting	0.27	N/A	N/A
Purchase Order Header Creation	0.13	N/A	N/A
Purchase Order Line Creation	0.15	N/A	N/A
Purchase Order Receipts List Creation	0.32	N/A	N/A
Purchase Order Invoice Creation	0.74	N/A	N/A

Benchmark Transaction Profile – Scenario 1: Mixed Workload

The workload consists of the transactions described in the following table. The ratio represents the user breakdown in addition to the overall transaction rate breakdown.

	Transaction Detail
Sales Order Processing	**Sales Order Header Save** **Enter 5 Line Items** *[Trade Agreements]* *20% Lines Receive Standard Discounts* *Credit Limit Checking @ Line Level* *80% of Lines from 1,000 Item Pool* *20% of Lines from 5,000 Item Pool* *Automatic Reservations* *Markup Freight @ Order Level* *[Miscellaneous Charges]* *Detailed Sales Tax [6 Tax Codes]* **Generate Picking List and Shipping** **Generate Packing Slip** **Invoice Order** *Detailed Tax and Chart of Accounts Update* *Commission Calculation* *Cost Accounting Update* *Credit Limit Checking @ Invoicing*
Purchase Order Processing	**Purchase Order Header Save** **Enter 5 Line Items** *Markup Transactions @ Order Level* **Generate Receipts List** **Create Invoice for Purchase Order**
Ledger Posting	**Create New Ledger** **Add 5 Lines** **Post Ledger**

Scenario Mix

	Number of Users	Transactions Per Hour Per User	Lines Per Hour Per User
Sales Orders	800	10	50
Purchase Order	150	10	50
Ledger Posts	50	10	50

Benchmark Transaction Profile – Scenario 2: Complex Sales Orders

This workload is sales orders only. It resembles Scenario 1, but without the purchase orders or the General Ledger postings. Sales orders are larger and more processing-intensive transactions and are benchmarked separately to provide an additional data point.

	Transaction Detail
Sales Order Processing	**Sales Order Header Save** **Enter 5 Line Items** *[Trade Agreements]* *20% Lines Receive Standard Discounts* *Credit Limit Checking @ Line Level* *80% of Lines from 1,000 Item Pool* *20% of Lines from 5,000 Item Pool* *Automatic Reservations* *Markup Freight @ Order Level* *[Miscellaneous Charges]* *Detailed Sales Tax [6 Tax Codes]* **Generate Picking List and Shipping** **Generate Packing Slip** **Invoice Order** *Detailed Tax and Chart of Accounts Update* *Commission Calculation* *Cost Accounting Update* *Credit Limit Checking @ Invoicing*

Scenario Mix

	Number Of Users	Transactions Per Hour Per User	Lines Per Hour Per User
Sales Orders	1,000	10	50

Benchmark Transaction Profile – Scenario 3: Simple Sales Orders for Industry Compare

This workload is sales orders only. It differs from Scenario 2 in the following ways:

- Functionality is significantly reduced to enable comparing Microsoft Dynamics AX 4.0 with other industry benchmarks that test limited functionality.
- This scenario is not suitable for sizing core sales order functionality for production runs, unless the functional settings are similar.
- The following functionality from Scenario 1 and 2 was disabled:
    - Trade Agreements
    - Credit Limit Checking
    - Markup Transactions
    - Automatic Reservations
    - Commission Calculation
    - Shipping Information for Order

	Transaction Detail
Sales Order Processing	**Sales Order Header Save** **Enter 5 Line Items** ***No Trade Agreements*** ***No Credit Limit Checking*** *80% of Items - 1,000 Item Pool, 20% from 5,000 Item Pool* ***No Automatic Reservations*** ***No Markup Freight @ Order Level*** *[Miscellaneous Charges]* *Detailed Sales Tax [6 Tax Codes]* **Generate Picking List** ***No Shipping Information Generated for Order*** **Generate Packing Slip** **Invoice Order** *Detailed Tax and Chart of Accounts Update [Ledger]* ***No Commission Calculation for Order*** *Cost Accounting Update* ***No Credit Limit Checking @ Invoicing***

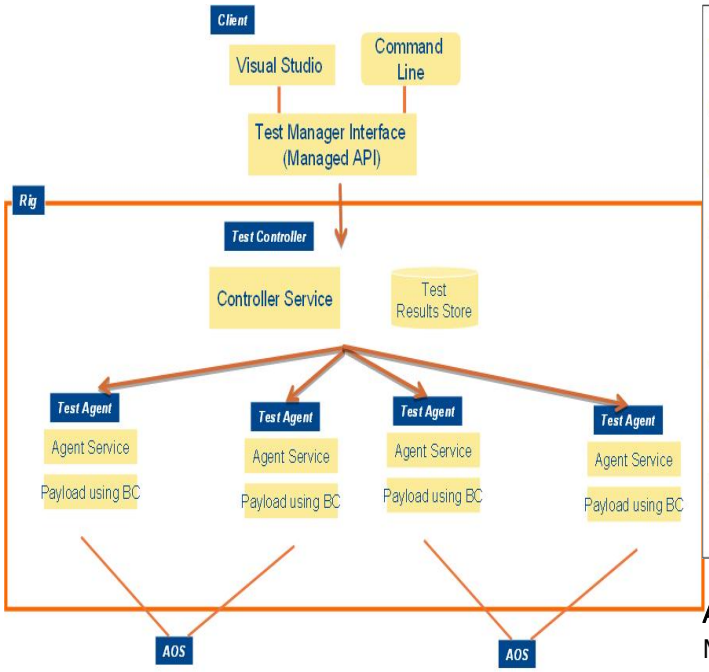
Scenario Mix

	Number Of Users	Transactions per Hour Per User	Lines Per Hour Per User
Sales Orders	3,000	10	50

Benchmark Methodology

Microsoft® Visual Studio® 2005 Team System was used as the load driver, simulating concurrent users through Microsoft Dynamics AX .NET Business Connector. A business transaction was simulated at an average rate of once every six minutes for each concurrent user.

Measurements were recorded on all servers and were measured when the concurrency reached steady state. Steady state was maintained for a minimum of 60 minutes with repeat runs within acceptable deviation of throughput and response times.



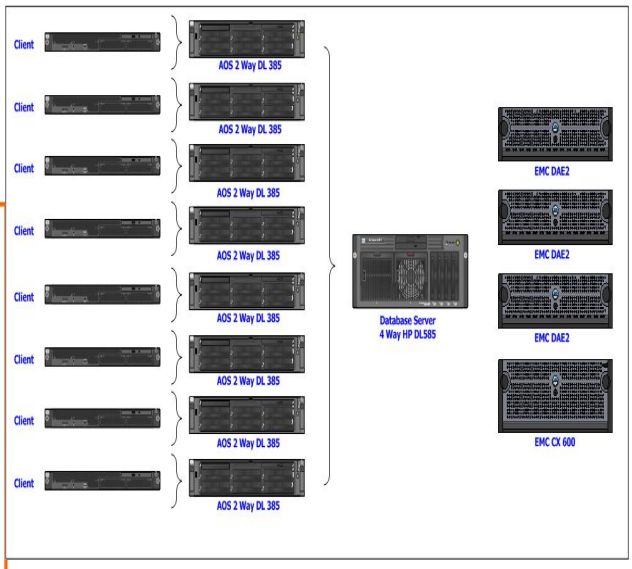


Figure 1: *Benchmark Methodology using Visual Studio Team System.*

Notes:

- All runs had a minimum steady state of 1 hour.
- Ramp up durations were between 20 and 45 minutes depending on the scenario.
- Scenarios were considered successful when deviations between runs were within 3% in terms of response time and system utilization.
- A benchmark user logs on through a business connector. Every effort has been made to simulate standard client behavior. Some differences exist between standard client and business connector users.

Hardware Layout and Configuration

All scenarios were run using the same hardware configuration of 8 homogeneous AOS servers communicating with a single instance Microsoft SQL Server™ 2005 database:

AOS Server Specification

Model HP DL385
Processor 2 x 2.6 gigahertz (GHz) AMD64
Memory 4 GB ECC
HardDisk (BootDrive) 2 x 72 gigabyte (GB) 15K RPM Raid1
HardDisk (PageFile) 1 x 36 GB 15K RPM
Network HP NC7782 Gigabit Ethernet

AOS Software Settings

3 GB Switch
32-bit version of Microsoft Windows Server® 2003 with Service Pack SP1 (SP1), Enterprise Edition
Single AOS instance per server

Visual Studio Team System Client Specification

Model HP DL145
Processor 2 x 1.8 GHz AMD64
Memory 2 GB ECC
HardDisk Maxtor 40 GB IDE
Network Broadcom NetXtream Gigabit Ethernet

Visual Studio Team System Software Settings

32-bit version of Windows Server 2003 with SP1, Standard Edition

Database Server Specification

Model HP DL585
Processor 4 x 2.6 GHz AMD64
Memory 16 GB ECC
HardDisk (BootDrive) 2 x 72 GB 15K RPM Raid1
HardDisk (PageFile) 1 x 36 GB 15K RPM
Network Broadcom NetXtream Gigabit Ethernet

Database Software Settings

3 GB Switch
64-bit version of Windows Server 2003 with SP1, Enterprise Edition
32-bit version of Microsoft SQL Server 2005 with Service Pack 1 (SP1)

Database Disk Configuration

EMC CX600 /w 4 GB 50/50
Raid Group 0 14 x 73 GB 10K RPM Raid 0 (Database)
Raid Group 1 04 x 73 GB 10K RPM Raid 0 (Log)
Raid Group 2 14 x 73 GB 10K RPM Raid 0 (Database)
Raid Group 3 10 x 73 GB 10K RPM Raid 0 (TempDB)

Benchmark Data Composition

The benchmark was run on a 177 GB base database. The system was configured as follows:

- 50,000 customers across 100 customer groups
- 100,000 items across 100 item groups
- 20,000 vendors across 100 vendor groups
- Pricing enabled for all items (Quantity >10 gets 5% line discount or total sale > $ 150 gets 2% discount)
- Chart of Accounts set up to generate 12 to 22 entries per 5 line sales order
- 6 Sales Tax Codes set up for orders
- 10 different Miscellaneous Charges per company
- Commission calculation set up
- Shipment enabled for core scenarios
- History:
    a. 2.5 million invoiced sales orders, 12.5 million lines
    b. 100,000 purchase orders, 500,000 purchase order lines invoiced

Disclaimer

These benchmark results were returned in a controlled lab environment, without other applications running during execution. The benchmark was executed on optimized hardware, using the Microsoft Dynamics AX 4.0 SYS layer without reporting activity during execution. This benchmark is accurate only for the listed hardware, non-customized version of Microsoft Dynamics AX, transaction mix, data composition, and indexes. Microsoft Dynamics is publishing a Benchmark Toolkit for Microsoft Dynamics AX before the end of 2006 on PartnerSource and CustomerSource. Any customer or partner running benchmarks on their own system should expect varying results based on their hardware, customizations, transaction mix, data composition, and indexes. Transaction mix and data composition will have an effect on sizing and hardware requirements.